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Yu et al.

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(45) **Date of Patent: Jan. 5, 2016**

(54) **METHOD FOR REDUCING CROSSTALK OF STEREOSCOPIC IMAGE**

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(73) Assignee: **AU Optronics Corp.**, Science-Based Industrial Park, Hsin-Chu (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 335 days.

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Jan. 15, 2013 (TW) .... 102101523 A

(51) **Int. Cl.**

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H04N 1/00	(2006.01)
G06T 19/20	(2011.01)
G02B 27/22	(2006.01)
H04N 13/00	(2006.01)

(52) **U.S. Cl.**

CPC ***H04N 13/04*** (2013.01); ***H04N 13/0007*** (2013.01); *G02B 27/22* (2013.01); *G06T 19/20* (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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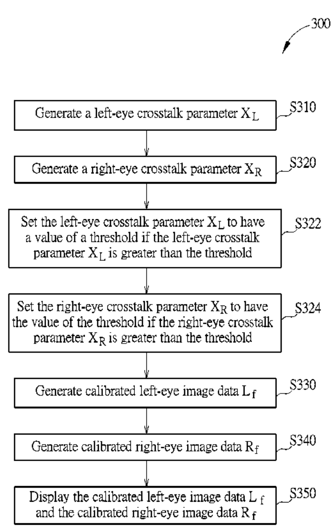
(57) **ABSTRACT**

A stereoscopic display method includes generating a left-eye crosstalk parameter according to left-eye image data and right-eye image data; generating a right-eye crosstalk parameter according to the left-eye image data and the right-eye image data; generating calibrated left-eye image data according to the left-eye image data, the right-eye image data, the left-eye crosstalk parameter, and the right-eye crosstalk parameter; generating calibrated right-eye image data according to the left-eye image data, the right-eye image data, the left-eye crosstalk parameter, and the right-eye crosstalk parameter; and displaying the calibrated left-eye image data and the calibrated right-eye image data on a display apparatus.

14 Claims, 10 Drawing Sheets



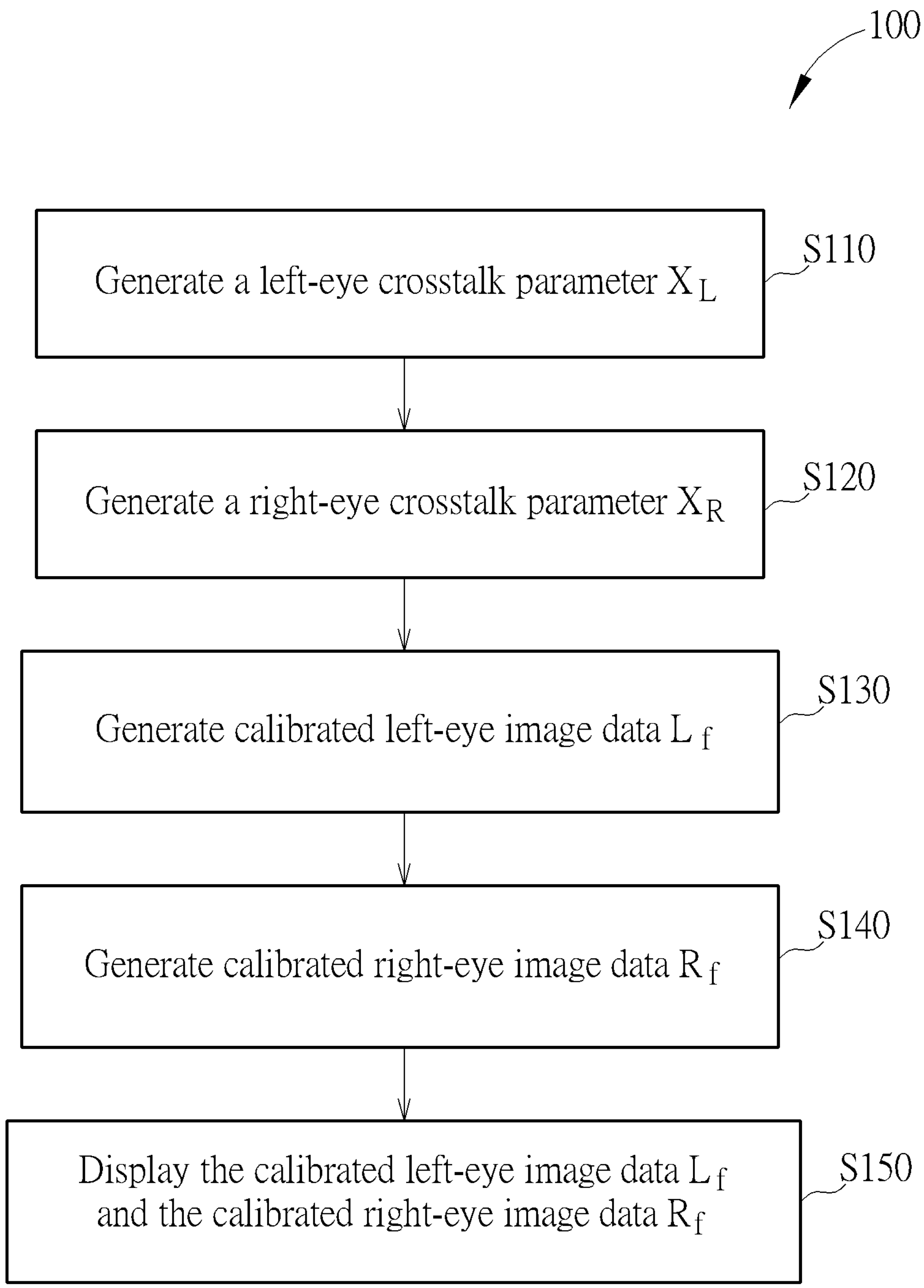

100
Generate a left-eye crosstalk parameter X_L
S110
Generate a right-eye crosstalk parameter X_R
S120
Generate calibrated left-eye image data L_f
S130
Generate calibrated right-eye image data R_f
S140
Display the calibrated left-eye image data L_f and the calibrated right-eye image data R_f
S150

FIG. 1A

LX-LUT		Right-eye grey level																
		0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	255
Left-eye (viewing-eye) grey level	0	0	9.8%	9.7%	9.9%	9.9%	9.9%	10.0%	10.0%	10.0%	10.2%	10.6%	11.1%	11.6%	12.1%	13.2%	15.1%	16.9%
	16	32.0%	0	7.7%	4.4%	2.7%	1.7%	2.6%	4.4%	5.6%	6.6%	7.6%	8.5%	9.4%	10.2%	11.5%	13.6%	15.6%
	32	22.9%	14.0%	0	18.1%	11.1%	3.6%	6.3%	2.3%	0.6%	0.2%	2.3%	4.2%	5.8%	7.0%	8.8%	11.3%	13.5%
	48	23.4%	2.7%	11.5%	0	16.3%	9.6%	9.1%	6.1%	4.6%	3.5%	0.9%	0.1%	1.1%	3.0%	5.2%	8.2%	10.8%
	64	19.8%	5.5%	12.8%	4.2%	0	9.3%	9.9%	9.0%	7.1%	4.7%	3.5%	2.2%	0.4%	0.8%	0.7%	4.2%	7.1%
	80	16.0%	14.2%	1.5%	0.0%	3.1%	0	7.6%	4.0%	7.4%	6.8%	4.3%	3.7%	3.0%	1.9%	2.3%	1.3%	3.1%
	96	13.8%	16.3%	2.1%	0.7%	0.6%	7.6%	0	8.6%	5.8%	3.7%	4.9%	5.4%	3.8%	3.1%	3.5%	3.3%	3.1%
	112	12.8%	13.7%	1.2%	2.6%	1.1%	7.2%	1.1%	0	7.9%	3.4%	4.3%	4.1%	4.3%	5.4%	4.9%	5.8%	9.0%
	128	11.6%	13.5%	12.5%	4.9%	0.1%	3.0%	4.0%	5.1%	0	4.1%	6.4%	5.1%	4.5%	4.7%	6.0%	6.2%	11.2%
	144	10.8%	11.4%	15.3%	5.6%	3.0%	3.1%	4.5%	6.6%	3.4%	0	8.7%	5.1%	5.4%	4.8%	5.8%	6.3%	9.6%
	160	8.6%	8.9%	9.5%	8.4%	4.8%	5.4%	4.2%	5.9%	4.0%	5.2%	0	7.6%	6.8%	5.3%	5.8%	5.9%	9.2%
	176	6.2%	7.4%	6.8%	8.9%	6.0%	5.4%	3.5%	5.5%	5.3%	7.0%	1.8%	0	9.4%	5.6%	6.9%	6.5%	9.4%
	192	4.8%	5.7%	5.0%	6.3%	7.2%	5.1%	3.9%	5.4%	6.5%	6.2%	3.3%	4.1%	0	5.4%	8.2%	7.2%	10.4%
	208	4.9%	4.8%	5.2%	5.5%	5.5%	5.1%	3.5%	3.9%	4.6%	5.1%	3.9%	5.7%	9.1%	0	8.2%	6.4%	10.6%
	224	3.3%	3.9%	3.2%	4.2%	4.4%	5.1%	2.8%	2.4%	4.6%	4.9%	4.5%	4.3%	4.2%	4.6%	0	3.3%	7.8%
	240	2.4%	2.7%	2.3%	2.6%	3.0%	3.7%	4.7%	4.1%	4.5%	5.1%	4.6%	5.4%	5.9%	6.2%	6.8%	0	5.4%
	255	4.8%	4.8%	4.8%	4.8%	5.4%	5.7%	4.9%	4.6%	4.5%	4.6%	4.5%	4.3%	5.5%	6.1%	6.9%	9.3%	0

FIG. 1B

RX-LUT		Left-eye grey level																
		0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	255
Right-eye (viewing-eye) grey level	0	0	9.3%	8.6%	8.6%	8.3%	8.2%	8.1%	8.0%	8.0%	8.1%	8.4%	8.8%	9.2%	9.6%	10.5%	12%	13.2%
	16	18.2%	0	4.9%	2.0%	0.9%	0.4%	1.5%	3.0%	4.0%	4.9%	5.7%	6.4%	7.2%	7.9%	8.9%	10.6%	12.0%
	32	10.2%	8.8%	0	14.3%	8.8%	0.8%	3.5%	0.1%	2.1%	1.5%	0.7%	2.3%	3.8%	4.9%	6.4%	8.4%	10%
	48	11.9%	12.8%	20.3%	0	12.4%	6.3%	6.0%	3.2%	2.1%	1.1%	1.1%	1.7%	0.6%	1.0%	3%	5.5%	7.4%
	64	10.3%	4.4%	20.7%	10.0%	0	5.5%	6.4%	5.4%	3.8%	1.7%	0.7%	0.4%	1.9%	1.5%	1.5%	1.5%	3.9%
	80	7.5%	5.9%	9.1%	5.9%	8.6%	0	3.5%	0.5%	4.0%	3.3%	0.8%	0.4%	0.2%	1.2%	0.7%	1.7%	0.3%
	96	6.3%	8.9%	9.5%	5.2%	5.2%	2.3%	0	5.3%	2.5%	0.2%	1.3%	1.8%	0.2%	0.7%	0.5%	0.8%	1.4%
	112	5.6%	6.7%	8.0%	3.7%	6.7%	1.4%	4.6%	0	5.6%	0.1%	0.7%	0.3%	0.4%	1.6%	0.6%	1.2%	3.1%
	128	6.0%	6.7%	6.8%	0.4%	5.8%	2.2%	2.0%	1.2%	0	1.7%	3.1%	1.1%	0.2%	0.6%	1.7%	1.2%	4.6%
	144	5.4%	6.1%	9.2%	0.7%	2.1%	2.1%	0.9%	1.1%	0.2%	0	6.1%	1.1%	0.7%	0.1%	1.1%	1.1%	2.3%
	160	3.9%	3.9%	4.1%	3.1%	0.5%	0.7%	0.9%	0.8%	0.4%	3.3%	0	4.3%	2.2%	0.3%	0%	0.2%	1.4%
	176	2.1%	3.1%	2.4%	4.0%	1.2%	1.5%	0.8%	0.8%	0.3%	3.3%	0.3%	0	3.8%	0.3%	0.5%	0.2%	1.0%
	192	0.7%	1.6%	0.9%	2.2%	2.6%	1.0%	0.1%	1.4%	2.1%	1.7%	0.3%	2.0%	0	0.8%	1.6%	0.2%	0.9%
	208	1.1%	1.2%	1.7%	1.6%	1.4%	1.2%	0.1%	0.3%	1.0%	1.2%	0.1%	2.3%	6.4%	0	1.3%	1.5%	0.2%
	224	0%	0.6%	0.1%	1.0%	0.6%	1.5%	0.3%	0.5%	0.9%	1.0%	0.7%	1.6%	0%	2.8%	0	5.6%	3.4%
	240	0.6%	0.3%	0.3%	0.2%	0.3%	0.5%	1.6%	1.7%	1.5%	1.7%	1.5%	2.4%	2.5%	1.2%	1.6%	0	4.8%
	255	3.3%	3.2%	3.2%	3.6%	3.8%	3.7%	3.4%	3.1%	3.1%	2.9%	2.8%	3.1%	3.4%	3.6%	3.8%	2.9%	0

FIG. 1C

Brightness (nits)		Right-eye grey level							
		0	16	32	48	64	80	96	112
Left-eye (viewing-eye) grey level	0	0.0360	0.2389	0.5714	0.9711	1.4806	2.0666	2.8075	3.6181
	16	1.4497	2.1144	2.3787	2.4429	2.4495	2.4356	2.7897	3.6143
	32	4.2902	5.0698	5.5525	6.2702	6.5564	6.0885	6.9519	6.2439
	48	7.2923	9.7136	9.9702	9.5131	10.3468	10.5689	11.1738	11.1355
	64	11.7446	13.9481	15.7986	14.8506	14.6360	15.1793	15.9378	16.5624
	80	17.2133	17.8813	20.7141	20.4908	20.6702	20.4902	21.0444	21.1048
	96	23.9032	23.5688	28.1988	27.6093	27.6663	27.1880	27.7394	28.4489
	112	31.3851	31.3470	36.3587	35.2993	36.2145	34.8715	35.8954	36.9845
	128	39.9557	39.4100	40.2470	43.4660	45.1791	44.4639	44.5174	44.7350
	144	48.7195	48.6229	47.1204	52.0897	53.4268	53.5598	53.4331	53.4106
	160	59.6254	59.6475	59.6002	60.5637	62.8289	62.8178	63.6858	63.5342
	176	71.9962	71.2717	71.9151	70.7843	73.0777	73.7425	75.0756	74.5554
	192	84.7614	84.0935	84.8464	84.0252	83.6947	85.4879	86.6505	86.1551
	208	96.2075	96.3910	96.2108	96.1169	96.3870	97.0804	98.5514	98.6204
	224	110.8838	110.3325	111.1456	110.2290	110.2722	109.8593	112.1960	112.7414
	240	125.3162	125.0920	125.6012	125.3568	125.0551	124.4204	123.7559	124.6746
	255	132.4436	132.5286	132.6707	132.8026	132.3527	132.3416	133.6007	134.3620

FIG. 1D

Brightness (nits)		Right-eye grey level								
		128	144	160	176	192	208	224	240	255
Left-eye (viewing-eye) grey level	0	4.5726	5.5794	6.9276	8.5232	10.3753	12.2992	15.2125	19.4359	23.5418
	16	4.5361	5.5798	6.8977	8.4490	10.2904	12.2348	15.0781	19.3018	23.5115
	32	5.3165	5.4720	6.9302	8.5268	10.3786	12.2151	15.2034	19.3874	23.5272
	48	11.1711	11.0707	10.0211	9.4449	10.3676	12.2197	15.0300	19.3192	23.4789
	64	16.8126	16.5292	16.4064	16.0218	14.9562	15.3116	15.3493	19.3919	23.4622
	80	22.3082	22.8019	22.4047	22.5718	22.5593	22.0532	22.6908	21.8688	24.2170
	96	28.7462	28.7350	29.5701	30.3865	30.0952	30.0001	30.8175	31.0207	31.2310
	112	36.7117	36.6176	37.2467	37.6652	38.2755	39.4894	39.8055	41.3811	45.2966
	128	45.2101	45.5935	46.4891	46.8102	47.1733	47.8299	49.3708	50.3756	55.7059
	144	54.3128	54.6345	55.5564	55.7671	56.4914	56.8736	58.1119	59.2681	62.7258
	160	64.4523	64.7021	65.2563	66.1349	66.8650	67.1432	68.0975	69.9711	72.0659
	176	75.1226	75.2278	76.5800	76.7867	77.9373	78.1595	79.4035	80.1579	82.6683
	192	86.1728	86.8835	88.2398	88.5139	89.0137	89.6692	91.1196	91.8468	94.2276
	208	98.5670	98.7719	99.7446	99.7738	100.0489	101.1546	102.2677	102.9066	105.1647
	224	111.4918	111.7380	112.4646	113.0285	113.5957	114.0456	114.6685	115.1227	116.5785
	240	124.7306	124.7021	125.5245	125.6564	126.1344	126.7605	127.5112	128.4512	129.0235
	255	134.8658	135.1671	135.7417	136.3652	136.3206	136.7632	137.3947	138.0785	139.0711

FIG. 1E

Brightness (nits)		Left-eye grey level							
		0	16	32	48	64	80	96	112
Right-cyc (vicwing-cyc) grcy lcvel	0	0.0323	0.1847	0.4209	0.7036	1.0593	1.4732	1.9920	2.5690
	16	1.3747	1.6734	1.8141	1.7982	1.7735	1.7409	1.9888	2.5653
	32	4.0822	4.2905	4.5429	5.0213	5.2293	4.6471	5.2332	4.5806
	48	6.9470	8.6737	8.5567	7.8781	8.4332	8.4961	8.8610	8.6490
	64	11.1036	12.8432	13.9956	12.8196	12.3714	12.6614	13.1285	13.4071
	80	16.3048	16.6735	18.8079	18.1974	18.0748	17.6220	17.8485	17.6953
	96	22.6183	22.1441	26.0148	24.9944	24.7618	23.9934	24.1465	24.5436
	112	29.8318	29.6153	33.7861	32.4898	32.9002	31.4103	31.9502	31.6093
	128	37.6051	37.4459	37.6095	40.1392	41.6112	40.4951	40.3288	39.9064
	144	45.9937	45.7881	44.5934	48.3697	49.3966	49.3024	48.8511	48.4562
	160	56.0826	56.1414	56.1800	56.8256	58.1450	58.0731	58.6914	58.1526
	176	67.5045	66.8885	67.3654	66.5253	68.2800	68.1800	69.3194	68.6482
	192	79.5398	78.8545	79.4133	78.5153	78.3891	79.5057	80.0964	79.4363
	208	90.2497	90.1604	89.7811	89.9165	90.0853	90.3655	91.2972	91.0262
	224	103.5253	102.9900	103.4801	102.6118	102.9841	102.2780	103.8331	103.9449
	240	116.9783	116.7152	116.6403	116.5259	116.6125	115.8322	114.8716	114.8833
	255	123.7283	123.9038	124.0550	123.6867	123.6310	123.9365	124.4262	124.9652

FIG. 1F

Brightness (nits)		Left-eye grey level								
		128	144	160	176	192	208	224	240	255
Right-eye (viewing-eye) grey level	0	3.2349	3.9687	4.9247	6.0668	7.4081	8.7944	10.8698	13.9553	16.8703
	16	3.2151	3.9523	4.9109	6.0069	7.3150	8.7552	10.7896	13.8727	16.8604
	32	3.8094	3.8864	4.9365	6.0554	7.4010	8.7522	10.8834	13.9085	16.8341
	48	8.5456	8.3467	7.3316	6.8097	7.4179	8.7305	10.7862	13.8745	16.8243
	64	13.4176	12.9921	12.7071	12.1665	11.1009	11.1777	11.0061	13.9632	16.8493
	80	18.5202	18.6508	17.9651	17.8202	17.5065	16.7703	17.0117	15.9069	17.3321
	96	24.5442	24.1959	24.6006	24.9537	24.2517	23.7056	23.7777	23.4150	22.7375
	112	32.0761	31.6292	31.7913	31.7350	31.8928	32.5700	32.0716	32.5966	34.6221
	128	40.0088	40.1519	40.5741	40.3276	40.0993	40.2997	41.1196	40.9578	44.0392
	144	48.6267	48.6417	49.2333	48.8671	48.8548	48.6100	49.2520	49.4006	50.4542
	160	58.4497	58.0536	58.3701	58.8264	58.8547	58.2821	58.3791	58.4930	59.3784
	176	68.8632	68.2702	68.9135	68.9424	69.3681	69.0155	69.1092	68.8642	69.5547
	192	79.2774	79.5823	80.1737	79.9038	80.1282	80.0442	80.5123	80.0558	80.5431
	208	90.6930	90.7096	91.2459	90.7130	90.6201	91.2157	91.3797	90.8372	91.2992
	224	103.0042	103.0037	103.2660	103.0311	103.5688	103.9218	103.5704	102.8512	102.7323
	240	115.2125	115.1466	115.4418	115.1933	115.4152	116.0191	116.5317	116.3266	115.7635
	255	125.2672	125.6492	126.0287	126.1759	126.3531	126.6648	127.0648	127.6496	127.9841

FIG. 1G

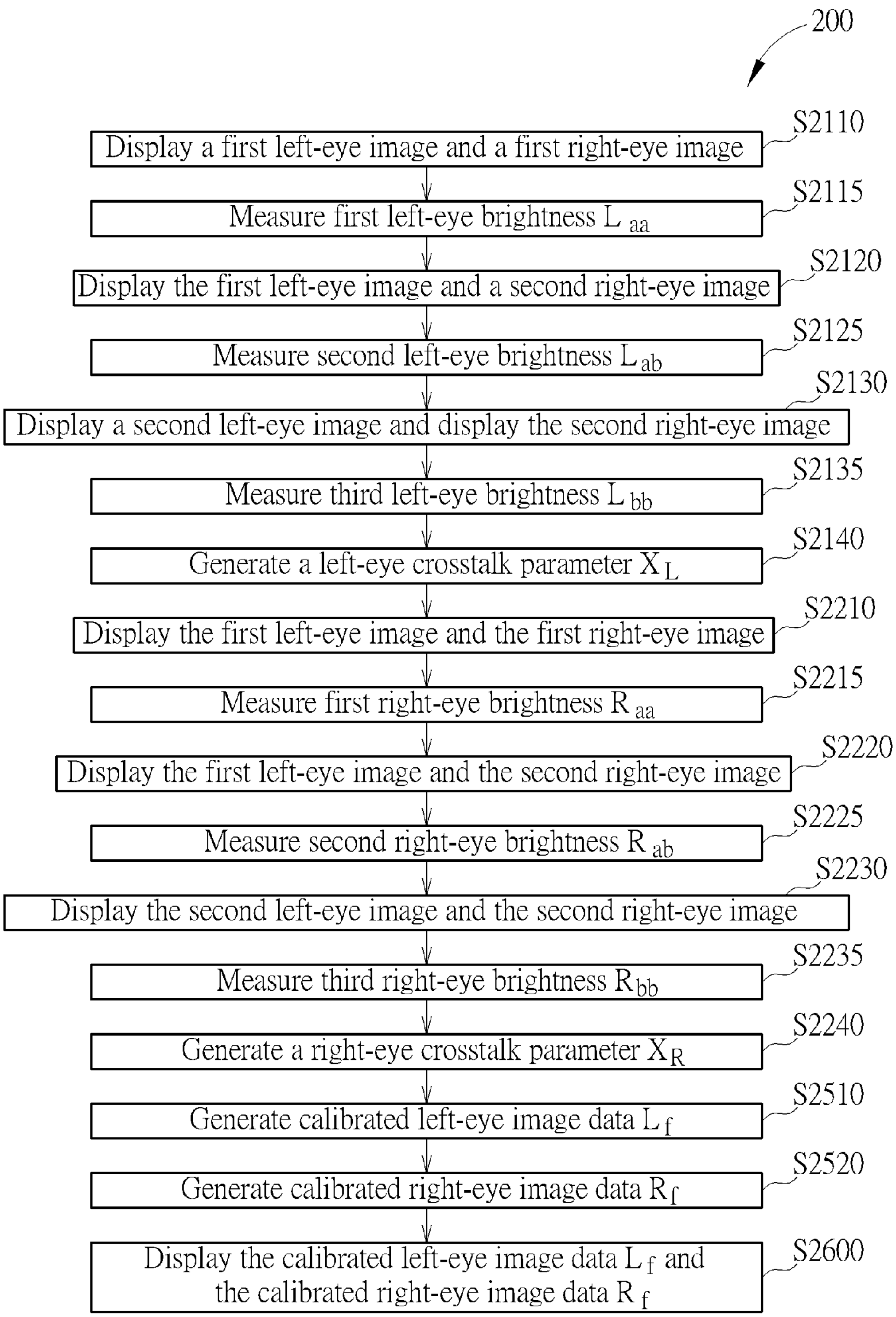

200
S2110
Display a first left-eye image and a first right-eye image
S2115
Measure first left-eye brightness L_{aa}
S2120
Display the first left-eye image and a second right-eye image
S2125
Measure second left-eye brightness L_{ab}
S2130
Display a second left-eye image and display the second right-eye image
S2135
Measure third left-eye brightness L_{bb}
S2140
Generate a left-eye crosstalk parameter X_L
S2210
Display the first left-eye image and the first right-eye image
S2215
Measure first right-eye brightness R_{aa}
S2220
Display the first left-eye image and the second right-eye image
S2225
Measure second right-eye brightness R_{ab}
S2230
Display the second left-eye image and the second right-eye image
S2235
Measure third right-eye brightness R_{bb}
S2240
Generate a right-eye crosstalk parameter X_R
S2510
Generate calibrated left-eye image data L_f
S2520
Generate calibrated right-eye image data R_f
S2600
Display the calibrated left-eye image data L_f and the calibrated right-eye image data R_f

FIG. 2

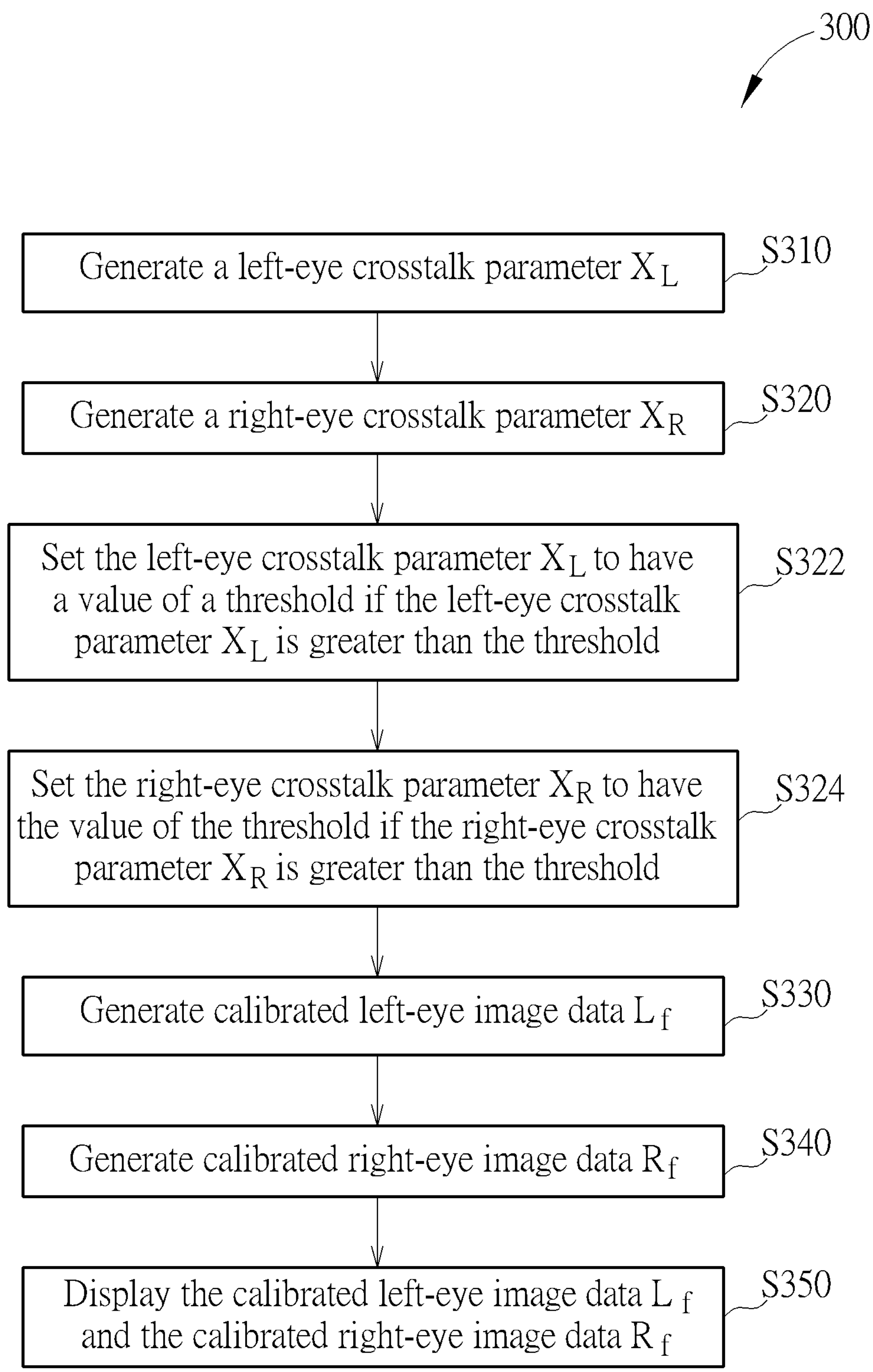

300
Generate a left-eye crosstalk parameter X_L
S310
Generate a right-eye crosstalk parameter X_R
S320
Set the left-eye crosstalk parameter X_L to have a value of a threshold if the left-eye crosstalk parameter X_L is greater than the threshold
S322
Set the right-eye crosstalk parameter X_R to have the value of the threshold if the right-eye crosstalk parameter X_R is greater than the threshold
S324
Generate calibrated left-eye image data L_f
S330
Generate calibrated right-eye image data R_f
S340
Display the calibrated left-eye image data L_f and the calibrated right-eye image data R_f
S350

FIG. 3

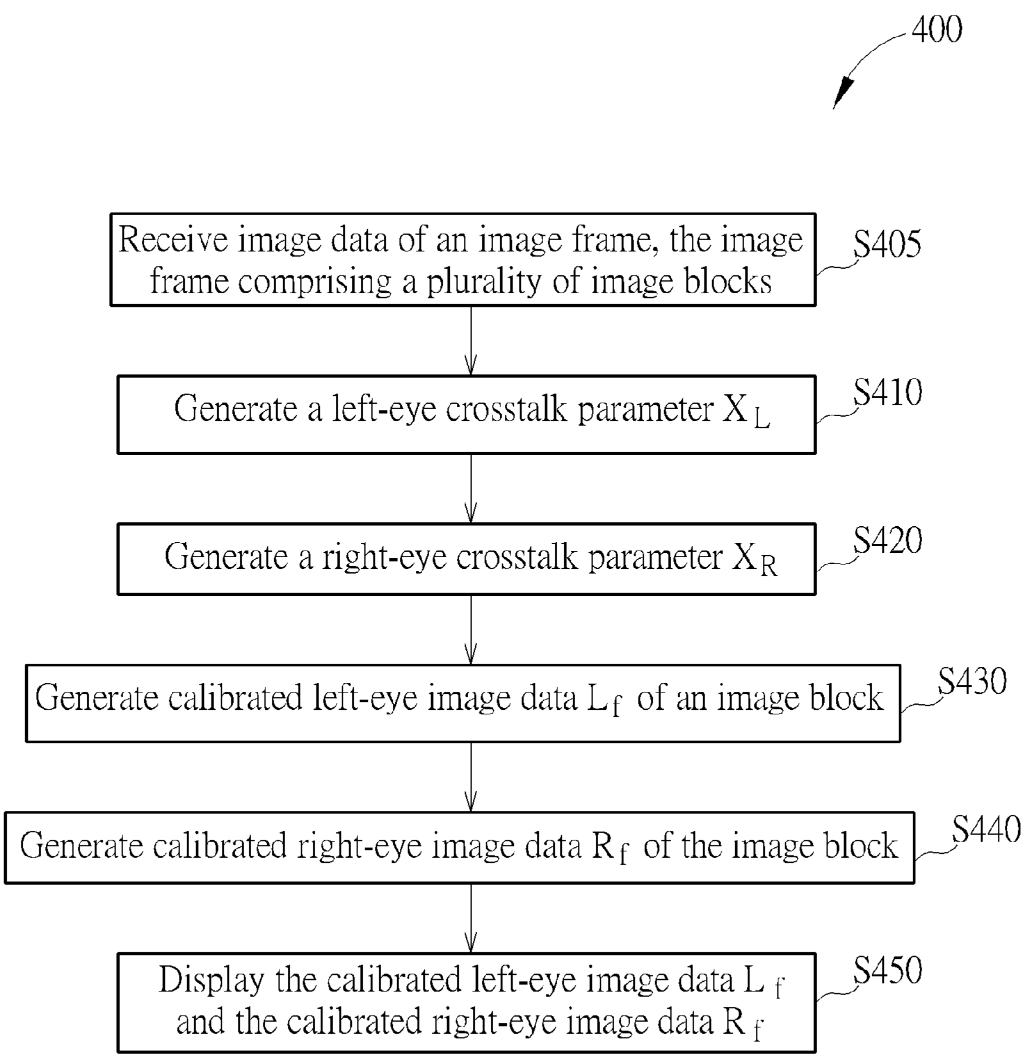

400
Receive image data of an image frame, the image frame comprising a plurality of image blocks
S405
Generate a left-eye crosstalk parameter X_L
S410
Generate a right-eye crosstalk parameter X_R
S420
Generate calibrated left-eye image data L_f of an image block
S430
Generate calibrated right-eye image data R_f of the image block
S440
Display the calibrated left-eye image data L_f and the calibrated right-eye image data R_f
S450

FIG. 4

METHOD FOR REDUCING CROSSTALK OF STEREOSCOPIC IMAGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present disclosure relates generally to a stereoscopic image compensation method, and more particularly, to a stereoscopic image compensation method for reducing stereoscopic image crosstalk.

2. Description of the Prior Art

As technology advances, the desire for better image display quality has gradually increased. In order to imitate real image display, stereo display technology has become the focus of development. The most common stereo display technologies are naked-eye stereo display technology and glass-type stereo display technology. The glass-type stereo display technology can be implemented by a time-multiplexed stereo display apparatus with shutter glasses, a time-multiplexed stereo display apparatus with polarized glasses, and a spatial-multiplexed stereo display apparatus with polarized glasses. However, conventional stereo display apparatuses cannot completely separate left-eye stereoscopic images from right-eye stereoscopic images, and thus leads to crosstalk between the left-eye stereoscopic images and the right-eye stereoscopic images, degrading the image display quality of the stereo display apparatuses.

In general, the crosstalk of a stereo display panel is consistent throughout the display panel. Nevertheless, different kinds of stereo display technologies and processes might cause crosstalk variations in different parts of the stereo display panel. Therefore, using a fixed crosstalk compensation parameter to compensate crosstalk of the stereo display panel may result in under compensation and over compensation in different areas of the stereo display panel.

SUMMARY OF THE INVENTION

An embodiment of the present disclosure discloses a stereoscopic display method. The stereoscopic display method comprises generating a left-eye crosstalk parameter according to left-eye image data and right-eye image data; generating a right-eye crosstalk parameter according to the left-eye image data and the right-eye image data; generating calibrated left-eye image data according to the left-eye image data, the right-eye image data, the left-eye crosstalk parameter, and the right-eye crosstalk parameter; generating calibrated right-eye image data according to the left-eye image data, the right-eye image data, the left-eye crosstalk parameter, and the right-eye crosstalk parameter; and displaying the calibrated left-eye image data and the calibrated right-eye image data on a display apparatus.

Another embodiment of the present disclosure discloses a stereoscopic display method. The stereoscopic display method comprises receiving image data of an image frame, the image frame comprising a plurality of image blocks. In each of the image blocks, a left-eye crosstalk parameter is generated according to left-eye image data of the image block and right-eye image data of the image block; a right-eye crosstalk parameter is generated according to the left-eye image data and the right-eye image data; calibrated left-eye image data of the image block is generated according to the left-eye image data, the right-eye image data, the left-eye crosstalk parameter, and the right-eye crosstalk parameter; and calibrated right-eye image data of the image block is generated according to the left-eye image data, the right-eye image data, the left-eye crosstalk parameter, and the right-eye crosstalk parameter. The calibrated left-eye image data and calibrated right-eye image data of the image blocks are then displayed on a display apparatus.

Another embodiment of the present disclosure discloses a stereoscopic display system. The stereoscopic display system comprises a data driver, a stereo display apparatus electrically connected to the data driver, a memory electrically connected to the data driver, a left-eye grey level crosstalk look up table stored in the memory and a right-eye grey level crosstalk look up table stored in the memory. The data driver is configured to receive left-eye image data and right-eye image data of an image frame. The image frame comprises a plurality of image blocks. The stereo display apparatus is configured to display calibrated left-eye image data of the image blocks and calibrated right-eye image data of the image blocks. The left-eye grey level crosstalk look up table comprises left-eye crosstalk parameters caused by the right-eye image data when the display apparatus is viewed by a left eye. The right-eye grey level crosstalk look up table comprises right-eye crosstalk parameters caused by the left-eye image data when the display apparatus is viewed by a right eye.

These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A is a flowchart of a stereoscopic display method according to one embodiment of the present invention.

FIG. **1**B is the left-eye grey level crosstalk parameter look up table according to one embodiment the present invention.

FIG. **1**C is the right-eye grey level crosstalk parameter look up table according to one embodiment of the present invention.

FIGS. **1**D and **1**E are left-eye brightness tables according to one embodiment of the present invention.

FIGS. **1**F and **1**G are right-eye brightness tables according to one embodiment of the present invention.

FIG. **2** is a flowchart of a stereoscopic display method according to another embodiment of the present invention.

FIG. **3** is a flowchart of a stereoscopic display method according to another embodiment of the present invention.

FIG. **4** is a flowchart of a stereoscopic display method according to another embodiment of the present invention.

DETAILED DESCRIPTION

Exemplary applications of apparatuses and methods according to the present disclosure are described in this section. These examples are being provided solely to add context and aid in the understanding of the disclosure. It will thus be apparent to one skilled in the art that the present disclosure may be practiced without some or all of these specific details. In other instances, well known process steps have not been described in detail in order to avoid unnecessarily obscuring the present disclosure. Other applications are possible, such that the following examples should not be taken as limiting.

Referring to FIG. **1**A, FIG. **1**A is a flowchart of a stereoscopic display method **100** according to one embodiment of the present invention. Steps of the stereoscopic display method **100** are described as follows. The steps are not limited in the following sequence. For example, step **S120** can be performed before step **S110**.

S110: generate a left-eye crosstalk parameter X_L according to left-eye image data L_i and right-eye image data R_i;

S120: generate a right-eye crosstalk parameter X_R according to the left-eye image data L_i and the right-eye image data R_i;

S130: generate calibrated left-eye image data L_f according to the left-eye image data L_i, the right-eye image data R_i, the left-eye crosstalk parameter X_L, and the right-eye crosstalk parameter X_R;

S140: generate calibrated right-eye image data R_f according to the left-eye image data L_i, the right-eye image data R_i, the left-eye crosstalk parameter X_L, and the right-eye crosstalk parameter X_R; and

S150: display the calibrated left-eye image data L_f and the calibrated right-eye image data R_f on a display apparatus.

Detailed steps are depicted below. A stereo display apparatus receives the left-eye image data L_i and the right-eye image data R_i. The display apparatus can be a time-multiplexed stereo display panel or a spatial-multiplexed stereo display panel It has a memory unit. A left-eye grey level crosstalk parameter look up table LX-LUT and a right-eye grey level crosstalk parameter look up table RX-LUT are stored in the memory unit. The left-eye grey level crosstalk parameter look up table LX-LUT comprises left-eye crosstalk parameters X_L caused by the right-eye image data R_i when the display apparatus is viewed by a left eye. The right-eye grey level crosstalk parameter look up table RX-LUT comprises right-eye crosstalk parameter X_R caused by left-eye image data L_i when the display apparatus is viewed by a right eye. In step **S110**, a corresponding left-eye crosstalk parameter X_L is selected from the left-eye grey level crosstalk parameter look up table LX-LUT according to grey levels of the left-eye image data L_i and right-eye image data R_i. In step S**120**, a corresponding right-eye crosstalk parameter X_R is selected from the right-eye grey level crosstalk parameter look up table RX-LUT according to grey levels of the left-eye image data L_i and right-eye image data R_i.

Referring to FIG. **1**B, FIG. **1**B is the left-eye grey level crosstalk parameter look up table LX-LUT according to grey levels of the left-eye image data L_i and right-eye image data R_i, which represents the left-eye crosstalk parameter X_L of the left-eye image data L_i caused by the right-eye image data R_i when the display apparatus is viewed by the left eye. Grey levels of the left-eye image data L_i are shown along the y-axis and grey levels of the right-eye image data R_i are shown along the x-axis.

Referring to FIG. **1**C, FIG. **1**C is the right-eye grey level crosstalk parameter look up table RX-LUT according to grey levels of the left-eye image data L_i and right-eye image data R_i, which represents the right-eye crosstalk parameter X_R of the right-eye image data R_i caused by the left-eye image data L_i when the display apparatus is viewed by the right eye. Grey levels of the right-eye image data R_i are shown along the y-axis and grey levels of the left-eye image data L_i are shown along the x-axis. Grey level scale may be regarded as a standard color scale modeling image luminance of each pixel in grey scale. It can be scaled from 0 to 255, where 0 corresponds to the darkest grey level regarded as a black color and 255 represents the brightest grey level.

For example, when the grey level of the left-eye image data L_i is 112, the grey level of the right-eye image data R_i is 64, and the display apparatus is viewed by a left eye, step S**110** will generate a corresponding left-eye crosstalk parameter X_L of about 1.1% according to the left-eye grey level crosstalk parameter look up table LX-LUT. When the grey level of the left-eye image data L_i is 112, the grey level of the right-eye image data R_i is 64, and the display apparatus is viewed by a right eye, step S**120** will generate a corresponding right-eye crosstalk parameter X_R of about 5.4% according to the right-eye grey level crosstalk parameter look up table RX-LUT.

The left-eye grey level crosstalk parameter look up table LX-LUT and the right-eye grey level crosstalk parameter look up table RX-LUT may be designed adaptively according to characteristics of each display panel. Hence, the embodiment of this disclosure can be applied to various kinds of stereoscopic display panels.

In step **S130** and **S140**, a processing unit of the display apparatus may generate a calibrated left-eye image data L_f and a calibrated right-eye image data R_f according to the left-eye image data L_i, the right-eye image data R_i, the left-eye crosstalk parameter X_L and the right-eye crosstalk parameter X_R. The formulas can be described as below:

The calibrated left-eye image data is:

$$L_f = \frac{(L_i - R_i \times X_L)}{(1 - X_R \times X_L)}.$$

The calibrated right-eye image data is:

$$R_f = \frac{(R_i - L_i \times X_R)}{(1 - X_R \times X_L)}.$$

Divide a difference between the left-eye image data L_i and a product of the right-eye image data R_i and the left-eye crosstalk parameter X_L by a difference between 1 and a product of the left-eye crosstalk parameter X_L and the right-eye crosstalk parameter X_R to generate the calibrated left-eye image data L_f; and divide a difference between the right-eye image data R_i and a product of the left-eye image data L_i and the right-eye crosstalk parameter X_R by a difference between 1 and a product of the left-eye crosstalk parameter X_L and the right-eye crosstalk parameter X_R to generate the calibrated right-eye image data R_f.

In step **S150**, the calibrated left-eye image data L_f and the calibrated right-eye image data R_f are displayed on the display apparatus.

When the display apparatus displays image data of both eyes, and only the first eye of the two eyes is watching the display apparatus, the image data of the second eye will cause interference to the image data of the first eye. The level of interference is related to the gray level difference between the image data of the two eyes. In the first embodiment of the present disclosure, various left-eye crosstalk parameters X_L and right-eye crosstalk parameters X_R are generated according to various grey level combinations of the image data of the two eyes to prevent under compensation and over compensation caused by the conventional constant crosstalk parameter.

Referring to FIG. **2**, FIG. **2** is a flowchart of a stereoscopic display method **200** according to another embodiment of the disclosure. Steps of the stereoscopic display method **200** are described as follows. However the steps do not have to be in the following sequence. For example, steps S**2120** and S**2125** can be performed before steps S**2110** and S**2115**. Further certain steps can be combined. For instance, steps S**2115** and S**2215** can be performed when performing step S**2110**. In this way, step S**2210** can be skipped.

S**2110**: display a first left-eye image with first gray level, and display a first right-eye image with the first gray level, the first gray level being corresponding to left-eye image data L_i;

S**2115**: measure first left-eye brightness L_{aa} received by the left eye when displaying the first left-eye image and displaying the first right-eye image;

S2120: display the first left-eye image with the first gray level, and display a second right-eye image with a second gray level, the second gray level being corresponding to the right-eye image data R_i;

S2125: measure second left-eye brightness L_{ab} received by the left eye when displaying the first left-eye image and displaying the second right-eye image;

S2130: display a second left-eye image with the second gray level, and display the second right-eye image with the second gray level;

S2135: measure third left-eye brightness L_{bb} received by the left eye when displaying the second left-eye image and displaying the second right-eye image;

S2140: generate a left-eye crosstalk parameter X_L according to the first left-eye brightness L_{aa}, the second left-eye brightness L_{ab}, and the third left-eye brightness L_{bb};

S2210: display the first left-eye image with the first gray level, and display the first right-eye image with the first gray level;

S2215: measure first right-eye brightness R_{aa} received by a right eye when displaying the first left-eye image and displaying the first right-eye image;

S2220: display the first left-eye image with the first gray level, and display the second right-eye image with the second gray level;

S2225: measure second right-eye brightness R_{ab} received by the right eye when displaying the first left-eye image and displaying the second right-eye image;

S2230: display the second left-eye image with the second gray level and display the second right-eye image with the second gray level;

S2235: measure third right-eye brightness R_{bb} received by the right eye when displaying the second left-eye image and displaying the second right-eye image;

S2240: generate a right-eye crosstalk parameter X_R according to the first right-eye brightness R_{aa}, the second right-eye brightness R_{ab}, and the third right-eye brightness R_{bb};

S2510: generate calibrated left-eye image data L_f according to the left-eye image data L_i, the right-eye image data R_i, the left-eye crosstalk parameter X_L, and the right-eye crosstalk parameter X_R;

S2520: generate calibrated right-eye image data R_f according to the left-eye image data L_i, the right-eye image data R_i, the left-eye crosstalk parameter X_L, and the right-eye crosstalk parameter X_R; and

S2600: display the calibrated left-eye image data L_f and the calibrated right-eye image data R_f on a display apparatus.

Detailed steps are depicted below. The left-eye crosstalk parameter X_L caused by the difference between the left-eye image data L_i and the right-eye image data R_i can be calculated through an experimental analysis. In step **S2115**, the first left-eye brightness L_{aa} received by the left eye is measured when displaying the first left-eye image with the first gray level and displaying the first right-eye image with the first gray level. In step **S2125**, the second left-eye brightness L_{ab} received by the left eye is measured when displaying the first left-eye image with the first gray level and displaying the second right-eye image with the second gray level. In step **S2135**, the third left-eye brightness L_{bb} received by the left eye is measured when displaying the second left-eye image with the second gray level and displaying the second right-eye image with the second gray level. The first left-eye brightness L_{aa}, the second left-eye brightness L_{ab} and the third left-eye brightness L_{bb} can be measured by instruments such as a display color analyzer.

Then, in step **S2140**, the left-eye crosstalk parameter X_L can be generated according to the first left-eye brightness L_{aa}, the second left-eye brightness L_{ab}, and the third left-eye brightness L_{bb}. Specifically, the left-eye crosstalk parameter X_L can be calculated by the formula

$$X_L = \left|\frac{L_{aa} - L_{ab}}{L_{aa} - L_{bb}}\right|,$$

which is an absolute value of a ratio of a difference between the first left-eye brightness L_{aa} and the second left-eye brightness L_{ab} and a difference between the first left-eye brightness L_{aa} and the third left-eye brightness L_{bb}.

Referring to FIGS. **1**D and **1**E, FIGS. **1**D and **1**E are left-eye brightness tables according to grey levels of the left-eye image data L_i and right-eye image data R_i, which represents brightness observed by the left eye (left-eye brightness) when displaying corresponding left-eye image data L_i and corresponding right-eye image data R_i. Grey levels of the left-eye image data L_i are shown along the y-axis and grey levels of the right-eye image data R_i are shown along the x-axis. The brightness can be measured in nits (candela per square meter, cd/m^2), and it can be measured by the display color analyzer but not limited to such a device.

According to FIG. **1**D, the first left-eye brightness L_{aa} is 35.9845 nits when the grey levels of the left-eye image data L_i and the right-eye image data R_i are both 112; the second left-eye brightness L_{ab} is 36.2145 nits when the grey level of the left-eye image data L_i is 112 and the grey level of the right-eye image data R_i is 64; the third left-eye brightness L_{bb} is 14.6360 nits when the grey levels of the left-eye image data L_i and the right-eye image data R_i are both 64. By using the formula

$$X_L = \left|\frac{L_{aa} - L_{ab}}{L_{aa} - L_{bb}}\right|,$$

the left-eye crosstalk parameter X_L is calculated to be about 0.01077, essentially equals to 1.08%. As shown in FIG. **1**B, when the grey level of the left-eye image data L_i is 112 and the grey level of the right-eye image data R_i is 64, the left-eye crosstalk parameter X_L is about 1.1% which is similar to the calculated 1.08%. FIGS. **1**D and **1**E are experimental results, panels processed under similar condition may generate similar experimental results, however, not all panels processed under similar conditions always have similar characteristics.

In another example, the first left-eye brightness L_{aa} is 2.1144 nits when the grey levels of the left-eye image data L_i and the right-eye image data R_i are both 16; the second left-eye brightness L_{ab} is 2.3787 nits when the grey level of the left-eye image data L_i is 16 and the right-eye image data R_i is 32; the third left-eye brightness L_{bb} is 5.5525 nits when the grey levels of the left-eye image data L_i and the right-eye image data R_i are both 32. By using the formula

$$X_L = \left|\frac{L_{aa} - L_{ab}}{L_{aa} - L_{bb}}\right|,$$

the left-eye crosstalk parameter X_L is calculated to be about 0.0768, essentially equals to 7.68%. As shown in FIG. **1**B, when the grey level of the left-eye image data L_i is 16 and the grey level of the right-eye image data R_i is 32, the left-eye crosstalk parameter X_L is about 7.7% which is similar to the calculated 7.68%. Therefore, a desirable left-eye crosstalk parameter X_L can be approximated either through experimental results in FIGS. 1D and 1E or by referring to the left-eye grey level crosstalk parameter look up table LX-LUT which can be formed adaptively according to characteristics of each display panel or a viewer's choice so as to enhance image quality of a stereoscopic image by compensating crosstalk of the displayed image.

The right-eye crosstalk parameter X_R caused by the difference between the left-eye image data L_i and the right-eye image data R_i can be calculated through an experimental analysis. In step S2215, the first right-eye brightness R_{aa} received by a right eye is measured when displaying the first left-eye image with the first gray level and displaying the first right-eye image with the first gray level. In step S2225, the second right-eye brightness R_{ab} received by the right eye is measured when displaying the first left-eye image with the first gray level and displaying the second right-eye image with the second gray level. In step S2235, the third right-eye brightness R_{bb} received by the right eye is measured when displaying the second left-eye image with the second gray level and displaying the second right-eye image with the second gray level. The first right-eye brightness R_{aa}, the second right-eye brightness R_{ab}, and the third right-eye brightness R_{bb} can be measured by instruments such as a display color analyzer.

Then, in step S2240, the right-eye crosstalk parameter X_R can be generated according to the first right-eye brightness R_{aa}, the second right-eye brightness R_{ab}, and the third right-eye brightness R_{bb}. Specifically, the right-eye crosstalk parameter X_R can be calculated by the formula

$$X_R = \left|\frac{R_{ab} - R_{bb}}{R_{aa} - R_{bb}}\right|,$$

which is an absolute value of a ratio of a difference between the second right-eye brightness R_{ab} and the third right-eye brightness R_{bb} and a difference between the first right-eye brightness R_{aa} and the third right-eye brightness R_{bb}.

Referring to FIGS. 1F and 1G, FIG. 1E is a right-eye brightness table according to grey levels of the left-eye image data L_i and right-eye image data R_i, which represents brightness observed by the right eye (right-eye brightness) when displaying corresponding left-eye image data L_i and corresponding right-eye image data R_i. Grey levels of the left-eye image data L_i are shown along the x-axis and grey levels of the right-eye image data R_i are shown along the y-axis. The brightness can be measured in nits (candela per square meter, cd/m^2), and it can be measured by the display color analyzer but not limited to such a device.

According to FIG. 1F, the first right-eye brightness R_{aa} is 31.6093 nits when the grey levels of the left-eye image data L_i and the right-eye image data R_i are both 112; the second right-eye brightness R_{ab} is 13.4071 nits when the grey level of the left-eye image data L_i is 112 and the gray level of the right-eye image data R_i is 64; the third right-eye brightness R_{bb} is 12.3714 nits when the grey levels of the left-eye image data L_i and the right-eye image data R_i are both 64. By using the formula

$$X_R = \left|\frac{R_{ab} - R_{bb}}{R_{aa} - R_{bb}}\right|,$$

the right-eye crosstalk parameter X_R is calculated to be 0.0538 about 5.38%. As shown in FIG. 1C, when the grey level of the left-eye image data L_i is 112 and the grey of the right-eye image data R_i is 64, the right-eye crosstalk parameter X_R is about 5.4% which is similar to the calculated 5.38%. Therefore, a desirable right-eye crosstalk parameter X_R can be approximated either through experimental results in FIGS. 1F and 1G or by referring to the right-eye grey level crosstalk parameter look up table RX-LUT which can be formed adaptively according to characteristics of each display panel or a viewer's choice so as to enhance image quality of a stereoscopic image by compensating crosstalk of the displayed image. FIGS. 1F and 1G are experimental results, panels processed under similar condition may generate similar experimental results, however, not all panels processed under similar conditions always have similar characteristics.

The remaining steps S2510, S2520 and S2600 are essentially similar to steps S130, S140, and S150. The calibrated left-eye image data L_f and the calibrated right-eye image data R_f are generated according to the left-eye image data L_i, the right-eye image data R_i, the left-eye crosstalk parameter X_L and the right-eye crosstalk parameter X_R. Then the calibrated left-eye image data L_f and the calibrated right-eye image data R_f are displayed on the display apparatus.

Referring to FIG. 3, FIG. 3 is a flowchart of a stereoscopic display method 300 of another embodiment of the disclosure, steps of the stereoscopic display method 300 is described as following. However the steps do not have to be in the following sequence. For example, step S320 can be performed before step S310.

S310: generate a left-eye crosstalk parameter X_L according to left-eye image data L_i and right-eye image data R_i;

S320: generate a right-eye crosstalk parameter X_R according to the left-eye image data L_i and the right-eye image data R_i;

S322: set the left-eye crosstalk parameter X_L to have a value of a threshold if the left-eye crosstalk parameter X_L is greater than the threshold;

S324: set the right-eye crosstalk parameter X_R to have the value of the threshold if the right-eye crosstalk parameter X_R is greater than the threshold;

S330: generate calibrated left-eye image data L_f according to the left-eye image data L_i, the right-eye image data R_i, the left-eye crosstalk parameter X_L, and the right-eye crosstalk parameter X_R;

S340: generate calibrated right-eye image data R_f according to the left-eye image data L_i, the right-eye image data R_i, the left-eye crosstalk parameter X_L, and the right-eye crosstalk parameter X_R; and

S350: display the calibrated left-eye image data L_f and the calibrated right-eye image data R_f on a display apparatus.

Most steps of the stereoscopic display method 300 are similar to the stereoscopic display method 100. The difference between the stereoscopic display method 300 and the stereoscopic display method 100 is the stereoscopic display method 300 further comprises step S322 and step S324. Detailed explanation of steps S322 and S324 are depicted below. To avoid over compensation at a local area, a threshold can be assigned to be an upper limit for the left-eye crosstalk parameter X_L and the right-eye crosstalk parameter X_R. The threshold can be assigned a value automatically or manually. If the left-eye crosstalk parameter X_L is larger than the threshold, the left-eye crosstalk parameter X_L is assigned to have the value of the threshold. If the right-eye crosstalk parameter X_R is larger than the threshold, the right-eye crosstalk parameter X_R is assigned to have the value of the threshold. Take FIG. **1**B as an example, most of the left-eye crosstalk parameters X_L are smaller than 10% but some of them are larger than 10%. If a left-eye crosstalk parameter X_L having a value greater than 10% is used to calibrate the left-eye image data L_i at the local area, the generated calibrated left-eye image data L_f might be overly compensated.

In other words, the effect of crosstalk is less strong in certain ranges of gray levels. For instance, in a dark image, if a large crosstalk parameter is used to calibrate image data, the calibrated image data might be overly compensated. Hence, a grey level range can be chosen, and a crosstalk parameter in the range can be assigned to have a value of a threshold if the crosstalk parameter is greater than the threshold, but a crosstalk parameter outside the range need not be assigned to have a value of a threshold if the crosstalk parameter is greater than the threshold. Please refer to FIG. **1**B, the left-eye crosstalk parameters X_L differ substantially for left-eye grey levels less than 144 and right-eye grey levels less than 32. Thus the left-eye crosstalk parameters X_L having a value greater than 10% in this range can be assigned a value of 10% or another percentage to minimize the over compensation effect and to improve image quality. Please refer to FIG. **1**C, the right-eye crosstalk parameter X_R differ substantially for left-eye grey levels above 240. Thus right-eye crosstalk parameter X_R having a value greater than 10% in this range can be assigned a value of 10% or another percentage to minimize the over compensation effect and to improve image quality. In another embodiment, all crosstalk parameters having values greater than the threshold can be assigned to have the value of the threshold.

Referring to FIG. **4**, FIG. **4** is a flowchart of a stereoscopic display method **400** of another embodiment of the disclosure, steps of the stereoscopic display method **400** is described as following. However the steps do not have to be in the following sequence. For example, step S**420** can be performed before step S**410**.

S**405**: receive image data of an image frame, the image frame comprising a plurality of image blocks;

S**410**: generate a left-eye crosstalk parameter X_L according to left-eye image data L_i of an image block and right-eye image data R_i of the image block;

S**420**: generate a right-eye crosstalk parameter X_R according to the left-eye image data L_i and the right-eye image data R_i;

S**430**: generate calibrated left-eye image data L_f of the image block according to the left-eye image data L_i, the right-eye image data R_i, the left-eye crosstalk parameter X_L, and the right-eye crosstalk parameter X_R;

S**440**: generate calibrated right-eye image data R_f of the image block according to the left-eye image data L_i, the right-eye image data R_i, the left-eye crosstalk parameter X_L, and the right-eye crosstalk parameter X_R; and

S**450**: display the calibrated left-eye image data L_f and the calibrated right-eye image data R_f on a display apparatus.

Most steps of the stereoscopic display method **400** are similar to the stereoscopic display method **100**. The difference between the stereoscopic display method **400** and the stereoscopic display method **100** is the stereoscopic display method **400** further comprises step S**405**. In step S**405**, image data of an image frame is received, the image frame comprises a plurality of image blocks. Each of image blocks corresponds to an LX-LUT and an RX-LUT. Different image blocks may correspond to different sets of LX-LUT and RX-LUT so that identical image data in different image blocks may be calibrated differently. Since characteristics of a display apparatus may not be identical throughout the display apparatus, this approach of calibration can compensate inconsistencies in different parts of the display apparatus. Hence, using spatial divisional manner would be desirable if the display apparatus has some defects so as to generate a more consistent global area image.

Modified embodiments based on the disclosure can be applied to stereoscopic mobile display devices, electrical display devices and divisional stereoscopic display apparatus such as a patterned retarder display system. In order to avoid crosstalk effect by non-viewing eye, the left-eye image data L_i and right-eye image data R_i can be calibrated with opposite polarities. Time divisional stereoscopic display apparatus is also applied in the disclosure such as a scanning retarder display system to avoid crosstalk effect caused by scanning delay.

In summary, a stereoscopic display method is disclosed. The left-eye crosstalk parameters and right-eye crosstalk parameters are adjusted according to grey levels of left-eye image data and right-eye image data so as to prevent over compensation and under compensation of image data to enhance image quality. Still, the left-eye crosstalk parameters and right-eye crosstalk parameters can be adaptively adjusted according to various characteristics of display panels. Further a plurality of LX-LUTs and RX-LUTs corresponding to different portions of a display apparatus can be utilized to calibrate image data in different portions of the display apparatus.

Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

What is claimed is:

1. A stereoscopic display method, comprising:

generating a left-eye crosstalk parameter according to left-eye image data and right-eye image data;

generating a right-eye crosstalk parameter according to the left-eye image data and the right-eye image data;

generating calibrated left-eye image data by dividing a difference between the left-eye image data and a product of the right-eye image data and the left-eye crosstalk parameter by a difference between 1 and a product of the left-eye crosstalk parameter and the right-eye crosstalk parameter;

generating calibrated right-eye image data by dividing a difference between the right-eye image data and a product of the left-eye image data and the right-eye crosstalk parameter by a difference between 1 and a product of the left-eye crosstalk parameter and the right-eye crosstalk parameter; and

displaying the calibrated left-eye image data and the calibrated right-eye image data on a display apparatus.

2. The method of claim **1**, wherein:

generating the left-eye crosstalk parameter according to the left-eye image data and the right-eye image data comprises:

generating the left-eye crosstalk parameter according to a left-eye grey level crosstalk look up table, the left-eye image data, and the right-eye image data, wherein the left-eye grey level crosstalk look up table comprises left-eye crosstalk parameters caused by the right-eye image data when the display apparatus is viewed by a left eye; and generating the right-eye crosstalk parameter according to the left-eye image data and the right-eye image data comprises:

generating the right-eye crosstalk parameter according to a right-eye grey level crosstalk look up table, the left-eye image data, and the right-eye image data, wherein the right-eye grey level crosstalk look up table lists right-eye crosstalk parameters caused by the left-eye image data when the display apparatus is viewed by a right eye.

3. The method of claim **1**, wherein:

generating the left-eye crosstalk parameter according to the left-eye image data and the right-eye image data comprises:

displaying a first left-eye image with a first gray level, and displaying a first right-eye image with the first gray level;

measuring first left-eye brightness received by a left eye when displaying the first left-eye image and displaying the first right-eye image;

displaying the first left-eye image with the first gray level, and displaying a second right-eye image with a second gray level;

measuring second left-eye brightness received by the left eye when displaying the first left-eye image and displaying the second right-eye image;

displaying a second left-eye image with the second gray level, and displaying the second right-eye image with the second gray level;

measuring third left-eye brightness received by the left eye when displaying the second left-eye image and displaying the second right-eye image; and

generating the left-eye crosstalk parameter according to the first left-eye brightness, the second left-eye brightness, and the third left-eye brightness; and

generating the right-eye crosstalk parameter according to the left-eye image data and the right-eye image data comprises:

displaying the first left-eye image with the first gray level, and displaying the first right-eye image with the first gray level;

measuring first right-eye brightness received by a right eye when displaying the first left-eye image and displaying the first right-eye image;

displaying the first left-eye image with the first gray level, and displaying the second right-eye image with the second gray level;

measuring second right-eye brightness received by the right eye when displaying the first left-eye image and displaying the second right-eye image;

displaying the second left-eye image with the second gray level and displaying the second right-eye image with the second gray level;

measuring third right-eye brightness received by the right eye when displaying the second left-eye image and displaying the second right-eye image; and

generating the right-eye crosstalk parameter according to the first right-eye brightness, the second right-eye brightness, and the third right-eye brightness;

wherein the first gray level corresponds to the left-eye image data, and the second gray level corresponds to the right-eye image data.

4. The method of claim **3**, wherein:

generating the left-eye crosstalk parameter according to the first left-eye brightness, the second left-eye brightness, and the third left-eye brightness comprises:

generating an absolute value of a ratio of a difference between the first left-eye brightness and the second left-eye brightness and a difference between the first left-eye brightness and the third left-eye brightness; and

generating the right-eye crosstalk parameter according to the first right-eye brightness, the second right-eye brightness, and the third right-eye brightness comprises:

generating an absolute value of a ratio of a difference between the second right-eye brightness and the third right-eye brightness and a difference between the first right-eye brightness and the third right-eye brightness.

5. The method of claim **3**, wherein:

generating the left-eye crosstalk parameter X_L according to the first left-eye brightness, the second left-eye brightness, and the third left-eye brightness comprises:

$$X_L = \left|\frac{L_{aa} - L_{ab}}{L_{aa} - L_{bb}}\right|,$$

wherein X_L is the left-eye crosstalk parameter, L_{aa} is the first left-eye brightness, L_{ab} is the second left-eye brightness, L_{bb} is the third left-eye brightness; and

generating the right-eye crosstalk parameter X_R according to the first right-eye brightness, the second right-eye brightness, and the third right-eye brightness comprises:

$$X_R = \left|\frac{R_{ab} - R_{bb}}{R_{aa} - R_{bb}}\right|,$$

wherein X_R is the right-eye crosstalk parameter, R_{aa} is the first right-eye brightness, R_{ab} is the second right-eye brightness, R_{bb} is the third right-eye brightness.

6. The method of claim **1**, further comprising:

setting the left-eye crosstalk parameter as a threshold if the left-eye crosstalk parameter is not smaller than the threshold; and

setting the right-eye crosstalk parameter as the threshold if the right-eye crosstalk parameter is not smaller than the threshold.

7. The method of claim **1**, further comprising:

receiving the left-eye image data and the right-eye image data of an image frame, the image frame comprising a plurality of image blocks.

8. A stereoscopic display method, comprising:

receiving image data of an image frame, the image frame comprising a plurality of image blocks;

in each of the image blocks,

generating a left-eye crosstalk parameter according to left-eye image data of the image block and right-eye image data of the image block;

generating a right-eye crosstalk parameter according to the left-eye image data and the right-eye image data;

generating calibrated left-eye image data of the image block by dividing a difference between the left-eye image data and a product of the right-eye image data and the left-eye crosstalk parameter by a difference between 1 and a product of the left-eye crosstalk parameter and the right-eye crosstalk parameter; and

generating calibrated right-eye image data of the image block by dividing a difference between the right eye image data and a product of the left-eye image data and the right-eye crosstalk parameter by a difference between 1 and a product of the left-eye crosstalk parameter and the right-eye crosstalk parameter; and

displaying calibrated left-eye image data and calibrated right-eye image data of the image blocks on a display apparatus.

9. The method of claim **8**, wherein:

each of the image blocks corresponds to a left-eye grey level crosstalk look up table and a right-eye grey level crosstalk look up table, the left-eye grey level crosstalk look up table lists left-eye crosstalk parameters caused by the right-eye image data when the display apparatus is viewed by a left eye, and the right-eye grey level crosstalk look up table lists right-eye crosstalk parameters caused by the left-eye image data when the display apparatus is viewed by a right eye;

generating the left-eye crosstalk parameter according to the left-eye image data and the right-eye image data comprises:

generating the left-eye crosstalk parameter according to a corresponding left-eye grey level crosstalk look up table, the left-eye image data, and the right-eye image data; and

generating the right-eye crosstalk parameter according to the left-eye image data and the right-eye image data comprises:

generating the right-eye crosstalk parameter according to a corresponding right-eye grey level crosstalk look up table, the left-eye image data, and the right-eye image data.

10. The method of claim **8**, wherein:

generating the left-eye crosstalk parameter according to the left-eye image data and the right-eye image data comprises:

displaying a first left-eye image with a first gray level and a first right-eye image with the first gray level;

measuring first left-eye brightness received by a left eye when displaying the first left-eye image and the first right-eye image;

displaying the first left-eye image with the first gray level and a second right-eye image with a second gray level;

measuring second left-eye brightness received by the left eye when displaying the first left-eye image and the second right-eye image;

displaying a second left-eye image with the second gray level and a second right-eye image with the second gray level;

measuring third left-eye brightness received by the left eye when displaying the second left-eye image and the second right-eye image; and

generating the left-eye crosstalk parameter according to the first left-eye brightness, the second left-eye brightness, and the third left-eye brightness; and

generating the right-eye crosstalk parameter according to the left-eye image data and the right-eye image data comprises:

displaying the first left-eye image with the first gray level and the first right-eye image with the first gray level;

measuring first right-eye brightness received by a right eye when displaying the first left-eye image and the first right-eye image;

displaying the first left-eye image with the first gray level and the second right-eye image with the second gray level;

measuring second right-eye brightness received by the right eye when displaying the first left-eye image and the second right-eye image;

displaying the second left-eye image with the second gray level and the second right-eye image with the second gray level;

measuring third right-eye brightness received by the right eye when displaying the second left-eye image and the second right-eye image; and

generating the right-eye crosstalk parameter according to the first right-eye brightness, the second right-eye brightness, and the third right-eye brightness;

wherein the first gray level corresponds to the left-eye image data, and the second gray level corresponds to the right-eye image data.

11. The method of claim **10**, wherein:

generating the left-eye crosstalk parameter according to the first left-eye brightness, the second left-eye brightness, and the third left-eye brightness comprises:

generating an absolute value of a ratio of a difference between the first left-eye brightness and the second left-eye brightness and a difference between the first left-eye brightness and the third left-eye brightness; and

generating the right-eye crosstalk parameter according to the first right-eye brightness, the second right-eye brightness, and the third right-eye brightness comprises:

generating an absolute value of a ratio of a difference between the second right-eye brightness and the third right-eye brightness and a difference between the first right-eye brightness and the third right-eye brightness.

12. The method of claim **10**, wherein:

generating the left-eye crosstalk parameter according to the first left-eye brightness, the second left-eye brightness, and the third left-eye brightness comprises:

$$X_L = \left|\frac{L_{aa} - L_{ab}}{L_{aa} - L_{bb}}\right|,$$

wherein X_L is the left-eye crosstalk parameter, L_{aa} is the first left-eye brightness, L_{ab} is the second left-eye brightness, L_{bb} is the third left-eye brightness; and

generating the right-eye crosstalk parameter according to the first right-eye brightness, the second right-eye brightness, and the third right-eye brightness comprises:

$$X_R = \left|\frac{R_{ab} - R_{bb}}{R_{aa} - R_{bb}}\right|,$$

wherein X_R is the right-eye crosstalk parameter, R_{aa} is the first right-eye brightness, R_{ab} is the second right-eye brightness, R_{bb} is the third right-eye brightness.

13. The method of claim **8**, further comprising:

setting the left-eye crosstalk parameter to have a value of a threshold if the left-eye crosstalk parameter is greater than the threshold; and/or

setting the right-eye crosstalk parameter to have the value of the threshold if the right-eye crosstalk parameter is greater than the threshold.

14. The method of claim **13**, wherein:

the left-eye image data and the right-eye image data are between a lower bound and an upper bound.

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